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IN 77-FD-007

ODRC/SAIL INTERFACE CONTROL

DOCUMENT FOR SAIL OFT DATA TAPES

REVISION A
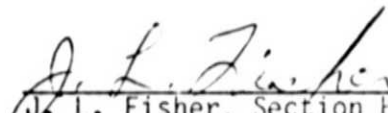
PREPARED BY:

ENGINEERING AND SPECIAL DEVELOPMENT BRANCH

INSTITUTIONAL DATA SYSTEMS DIVISION

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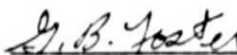
J. L. Fisher, Section Head
Test Data Reduction Section

A. W. Hambleton, Section Head
Mission Data Systems Section

Marlowe D. Cassetti, Chief
Engineering and Special Development
Branch

C. R. Huss, Chief
Institutional Data Systems
Division

B. R. Gantz
SAIL Data Manager

G. B. Foster, Chief
Instrumentation Integration Branch
Integration Division

PREPARED BY:

ENGINEERING AND SPECIAL DEVELOPMENT BRANCH
INSTITUTIONAL DATA SYSTEMS DIVISION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

MAY 1979

CONTENTS

ABBREVIATIONS AND ACRONYMS

ACM	Acquisition and Command Module
ATA	Avionics Test Article
BCD	Binary Coded Decimal
BITE	Built In Test Equipment
BP	Bit Position
BPI	Bits Per Inch
CCT	Computer Compatible Tape
CDC	Control Data Corporation
CDT	Compressed Data Tape
CFS	Command Format Sequencer
DCM	Display and Control Module
DBT	Data Bus Terminal
EBCDIC	Extended Binary Coded Decimal Interchange Code
EOF	End of File
EU	Engineering Units
FRAG	Fragment
GPC	General Purpose Computer
GSIU	Ground Standard Interface Unit
HEX	Hexadecimal
ICD	Interface Control Document
ID	Identification
IDSD	Institutional Data Systems Division
IN	Internal Note
IPS	Inches Per Second
IRIG	Instrumentation Interchange Information Group
JSC	Johnson Space Center
KBPS	Kilobits Per Second
LSB	Least Significant Bit
LDB	Launch Data Buss
MCC	Mission Control Center
MS	Milliseconds
MSB	Most Significant Bit
MTU	Master Timing Unit
MU	Master Unit

ODRC	Orbiter Data Reduction Complex
OFT	Orbital Flight Test
OI	Operational Instrumentation
PC	Processing Code
PCM	Pulse Code Modulation
SAIL	Shuttle Avionics Instrumentation Laboratory
SEC	Second
SIS	Shuttle Interface Simulator
SR	Samples Rate
TBD	To Be Determined
TICM	Test Interface Control Module
TOC	Test Operations Center
WC	Word Count

1. PURPOSE AND SCOPE

This document describes formats for all OFT magnetic tape recordings produced in the JSC SAIL which are required to be processed in the ODRC (Orbiter Data Reduction Complex) or by the MCC Network Interface Processor. These SAIL formats will be changed only by joint SAIL/IDSD approval via revisions to this document.

2. TOC COMPRESSED DATA TAPE

2.1 GENERAL

The SAIL Test Operations Center (TOC) has the capability for continuous recording of command and response data from the ATA and the Shuttle Dynamics Simulator. These data are recorded on a CDC Model 606 digital magnetic tape recorder. Data compression techniques are used to eliminate redundant data. The compression technique which is used compares each data value to the last output value and the value is recorded or not recorded based on the count value specified for that measurement on the TOC data base. This procedure is applicable for all sample rates.

2.2 PHYSICAL DESCRIPTION

- Written at 556 bpi density
- Odd parity
- 7 tracks
- 16 bits per word

2.3 TEST DATA LOG TAPE STRUCTURE

```
┌─────────────────────┐
│       LABEL         │
└─────────────────────┘

┌─────────────────────┐
│       BODY          │
│   (DATA RECORD)     │
└──────────────┘

┌─────────────────────┐
│       BODY          │
│   (DATA RECORD)     │
└──────────────┘

         •
         •
         •

┌─────────────────────┐
│       BODY          │
│   (DATA RECORD)     │
└──────────────┘

┌─────────────────────┐
│  TERMINATOR         │
│  RECORD             │
└─────────────────────┘
```

An end-of-file mark is not mandatory.

2.4 LABEL RECORD DESCRIPTION*

Word

1	/ F F F E :
2	0 0 0 0

	0	45	6	910	15
3	DAY	HOUR	MINS		
4	SEC	MILLISEC			
5	DCM ID				
6	JULIAN DAY				
7					
8	UNUSED				
9					

Julian Day is entered by DCM operator at TOC and is <u>not</u> updated.

2.5 BODY RECORD DESCRIPTION*

Word

1	LOG ID
2	/ F F F E
3	0 0 0 0

		45	6	910	
4	DAY	HOUR	MINS		
5	SEC	MS			
6-1007	LOG DATA				
≤ 1008	/FFFF				

Logical End of Record

The Log Data section shall be defined by each log type.

*All numbers and/or letters preceded by a / are hexadecimal.

4

2.5.1 TEST DATA LOG

The Test Data Log I.D. = 1.

All data base measurement data are entered into the body of each reel at least once.

The Log Data section is composed of three elements which may occur in any order and any number of times up to the limit of the physical record (Words 2 through 1007).

Element Formats:

1. Long Form Time of Day - 4 words

1	/FFFE

2	0000

	0 4 5 6 9 10 15
3	DAY HOUR MINS
4	SEC MS

2. Short Form Time of
Day - 2 words
Day, Hour, and
Minutes are same as
as previous Long
Form

1	/FFFC
2	SEC MS

3. Data - 3 words
to n words

1	ID
2	Word Count = n
	DATA
n	DATA

Data for any element will not be split between body records. The following sections describe the individual data elements on the TOC CDT (Compressed Data Tape) in terms of the data base defined parameters: Routing Code and Data Length.

2.5.1.1 PCM (ROUTING CODE = "A")

a) One to ten bit data

ID	
WC = 3	
C	S	DATA

ID between /1000 to /1FFF
Word Count = 3 always
(Starting ID will vary with each data base)

C: State change bit. Position 2^{15}
1 = State has changed since last entry.

S: State of measurement. Positions 2^{14} thru 2^{12}
Range of 0 to 4 is valid.

DATA: Data value, right justified in Position 2^{11} thru 2^{0}
Refer to data base for valid range.

b) Eleven to Sixteen bit data

ID	
WC = 4	
C	S	- 0 -
DATA	

ID between /0201 to /0FFF
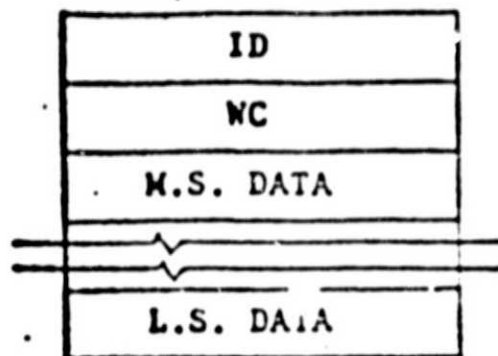Word Count = 4 always
(Ending ID will vary with each data base)

C: State change bit. Position 2^{15}

S: State of data. Position 2^{14} thru 2^{12}

DATA: Data value, right justified in word. Zero fill.

c) Thirty-two and Sixty-four bit data

```
+---------------+
|      ID       |      ID between /0201 to /0FFF (Ending ID will
+---------------+      vary with each data base.)
|      WC       |      Word Count = 4 or 6
+---------------+
|   M.S. DATA   |      M.S. DATA = Most Significant data
+---------------+                   word
|~~~~~~~~~~~~~~~|
|~~~~~~~~~~~~~~~|
+---------------+
|   L.S. DATA   |      L.S. DATA = Least Significant data
+---------------+                   word
```

2.5.1.2   GSIU (ROUTING CODE = "B")

a)   One to twelve bit data

```
+----------------------+
|          ID          |      ID between /0201 to /0FFF (Ending ID will
+----------------------+      vary with each data base.)
|        WC = 3        |      Word Count = 3 always
+-----+-----+----------+
|  C  |  S  |   DATA   |
+-----+-----+----------+
```

C: State change bit. Position 2^{15}

S: State of measurement. Position 2^{14} thru 2^{12}

DATA: Data value, right justified in Position 2^{11} thru 2^0.

b)   Greater than twelve bit data
     Not Applicable.

2.5.1.3   LAUNCH DATA BUS   (ROUTING CODE = "E")

a)   One to sixteen bits

```
+---------------+
|      ID       |      ID between /0064 to /0200
+---------------+
|    WC = 4     |      Word Count = 4 always
+---------------+
|     - 0 -     |      (filler word)
+---------------+
|     DATA      |      Data value right justified in word
+---------------+
```

b) Greater than sixteen bits data

Not Applicable.

2.5.1.4 TICM (ROUTING CODES "F" OR "G")

a) One bit data

ID
WC = 3

C	S	DATA

ID between /0201 to /0FFF (Ending ID will vary with each data base.)

Word Count = 3 always

C: State change bit. Position 2^{15}

S: State of measurement. Position 2^{14} thru 2^{12}

DATA: Data value, right justified in position 2^{11} thru 2^0

b) Two to sixteen bit data.

ID
WC = 4

C	S	- 0 -
DATA		

ID between /0201 to /0FFF (Ending ID will vary with each data base.)

Word Count = 4

C: State change bit. Position 2^{15}
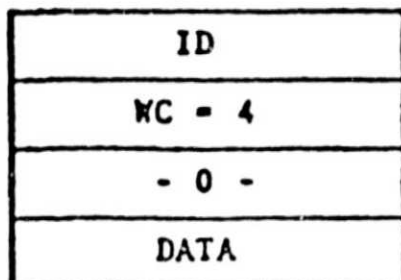
S: State of measurement. Position 2^{14} thru 2^{12}

DATA: Data value, right justified in word.

c) Thirty-two bit data

ID
WC = 4
M.S. DATA
L.S. DATA

ID between /0201 to /0FFF (Ending ID will vary with each data base.)

Word Count = 4 always

Most Significant Data Word

Least Significant Data Word

2.5.1.5. SPECIAL SYSTEM IDS

a) GPC sync in 128 KBS PCM

ID
WC = 4
- 0 -
INFO

ID = 0000

INFO = Bit 2^{15} = 1 GPC in sync

= 0 GPC out of sync

Bits 2^2-2^0 = GPC ID (1 to 5)

b) PCM sync

ID
WC = 4
- 0 -
INFO

ID = 0002

INFO = Bit 2^{15} = 1 PCM Hardware in sync

= 0 PCM Hardware out of sync

c) TICM/SIS Sync Status

ID
WC = 3
INFO

ID = 0004

INFO = Bit 2^0 = 1 TICM/SIS in sync

= 0 TICM/SIS sync loss

d) **TICM Tape Log Status**

ID
WC = 3
INFO

ID = /0005

INFO: Bit 2^0 = 0 TICM Tape Recording not active

= 1 TICM Tape Recording active

e) **TICM to ACM Bus Status**

ID
WC = 3
INFO

ID = /0006

INFO: Bit 2^0 = 0 TICM/ACM Bus Fault

= 1 TICM/ACM Bus Good

f) **Limits of SYSTEM ID's**

ID
WC = 6
INFO #1
INFO #2
INFO #3
INFO #4

ID = /0007 (Not processed by IDSD)

INFO #1 = System ID of first nonlimit check measurement (currently 0201_{16})

INFO #2 = System ID +1 of last nonlimit check measurement

INFO #3 = System ID of first limit check measurement (varies with each data base)

INFO #4 = System ID +1 of last limit check measurement.

g)   TICM Time Tag for TOC recording of command replies

ID
WC - 3
INFO

for ID = /000A

   INFO: = Upper Time Day-Hour-Minute

0	4	5	9	10	15
DAY		HOUR		MIN	

for ID = /000B

   INFO: = Lower Time second-millisecond

0	5	6	15
SEC		MS	

h)   GSIU Math Model activity recording

ID	
WC - 4	
Cell	Channel
Value	

ID - /2022 thru /2027
WC - 4 always
Cell: Bits 2^{15}-2^6
Channel: Bits 2^5-2^0
Value: Data transmitted from a GSIU Math Model to the designated cell and channel. The data are right justified, and State information is not applicable. If the transmitted datum is to a Digital Data Cell, the 4 discrete bits are right justified in value. If the transmitted datum is to an Analog Stimuli Cell, the 12 bit analog data are right justified in value.

2.5.1.6 STIMULUS RECORDING IDS

a) The CFS/LDB Commands

The CFS/LDB command message formats are as follows:

1. Command Received

ID
WC = 4
Data 1
Data 2

ID = /2000 thru /2011

WC = 4 for command received

Data 1:
Bits 2^{15} thru 2^{12}: Responsible DCM#
Bits 2^7 thru 2^0: Task# assigned by DCM

Data 2: Transaction# assigned by CFS

2. Command Executed

ID
WC
Data 1
Data 2
Data 3
⋮
Last Data Wd

ID = /2000 thru /2011

WC = 6 to 32 for command executed

Data 1: Same as command received

Data 2: Same as command received

Data 3:
Bits 2^{15} thru 2^8: Block# of this block.
Bits 2^7 thru 2^0: Number of blocks in total response.

Remainder of Transmission varies dependent upon ID.

Data 4 of Block #1 is status:
zero = successful completion.

b) **TICM Commands**

The TICM command message formats are as follows:

1. Command Received

ID	
WC = 4	
DCM	TASK
01	#WORDS

ID = /2020 or /2021

WC = 4 always

DCM = responsible DCM: Bits $2^{15}-2^8$

TASK = DCM assigned task number: Bits 2^7-2^0

#WORDS = Word count of uplinked command: Bits 2^7-2^0

2. Command Executed

ID	
WC	
DCM	TASK
Status	
01	#WORDS
echo of uplinked command as received	

ID = /2020 or /2021

DCM, Task and #Words: as above.

Status = zero: command was successfully completed.

Remainder of transmission is dependent upon the uplink command.

c) **GSIU Commands**

The GSIU command message formats are as follows:

1. Command Received

ID
WC
Data 1
Data 2
⋮
Last Data Wd

ID = /2028 always

Data #1
  Bits $2^{15}-2^{12}$ responsible DCM#
  Bits 2^7-2^0 command "op code"

Data #2
  Bits $2^{15}-2^8$ dependent on "op code"
  Bits 2^7-2^0 DCM assigned Task#.

Remainder of transmission dependent on op code.

2. Command Executed

ID
WC
Status
Data 1
Data 2
⋮
Last Data Wd

ID = /2029 always

Status: zero = successful completion

Remainder of transmission is bit for bit identical to corresponding command received transmission.

2.6 TERMINATOR RECORD DESCRIPTION

Word

1	/FFFF
2	
·	
·	UNUSED
·	
9	

3. TICM TAPE FORMATS

TICM recorded information will consist of only one basic
format. Data will be recorded on magnetic tape at 556 bits
per inch, odd parity, and seven tracks (6 bits data + 1 bit
parity). There will be 8 magnetic tape frames per 3 16-bit
words in binary.

Each magnetic tape reel shall consist of one or more of the
following: a body and an End-of-File, in that order. Termi-
nation of data on the tape will be indicated by a double
End-of-File. Record size and tape structure shall be:

>   body - any number of 2046 word records
>   EOF
>   body
>   EOF
>   o
>   o
>   o
>   o
>   o
>   body
>   EOF
>   EOF

Each body record is composed of five elments which are
described in the following sections.

3.1 TIME TAGS

a. Long Form Time of Day

```
 0     456        910      15
┌──────────────────────────┐
│            ID            ·│        ID=/8001
├──────┬───────────┬───────┤
│ DAY  │   HOUR    │ MINS  │
├──────┼───────────┴───────┤
│ SEC  │     MILLISEC      │
└──────┴───────────────────┘
```

b. Short Form Time of Day - Day, hour, and minutes are the same as previous Long Form

```
 0         56         15
┌─────────────────────┐
│         ID         ·│        ID=/0001
├──────────┬──────────┤
│   SEC    │ MILLISEC │
└──────────┴──────────┘
```

c. Julian Day - entered at time of TOC loading by DCM operator it appears at the beginning of every tape record, immediately following the long form time of day. The DCM does not update Julian day when GMT midnight occurs.

```
 0               15
┌─────────────────┐
│       ID        │        ID = ,'000c
├─────────────────┤
│   JULIAN DAY    │
└─────────────────┘
```

3.2 MEASUREMENT LIST

```
┌────────────────────┐
│        ID         ·│        ID=/0201 thru /1FFF
├────────────────────┤        (Ending ID will vary with each
│      · DATA        │        each data base.)
└────────────────────┘

         or

┌────────────────────┐
│        ID         ·│        ID=/8201 thru /9FFF
├────────────────────┤        (Ending ID will vary
│      DATA          │        with each data base.)
├────────────────────┤
│      DATA          │
└────────────────────┘
```

or

ID
DATA
DATA
DATA
DATA

ID=/C201 thru /CFFF

(Ending ID will vary with each data base.)

The two most significant bits in the measurement ID indicate:

$$00 = 16\text{-bit measurement}$$
$$10 = 32\text{-bit measurement}$$
$$11 = 64\text{-bit measurement}$$

3.3 ERROR INDICATOR

a) Hardware errors

```
0        78   11 12   15
┌────────────────┬───────┐
│       ID       │       │          ID=/0002
├──────────┬─────┴───────┤
│  Device  │    Error    │
└──────────┴─────────────┘
```

Device = 0	(TICM Processor)
Error = 0	(Multiply/Divide Overflow)
= 1	(Arithmetic Overflow)
= 2	(Multiply/Divide Busy)
Device = 1	(ATA Interface)
Error = 0	(no response)
= 1	(parity error)
= 2	(ATA busy)
Device = 2	(Parallel Bus)
Error = 0	(ACM no response)
= 1	(parity error)
= 2	(ACM busy)
Device = 3	(Parameter Frame)
Error = 0	(frame word count bad)
= 1	(short parameter set)
= 2	(SIS - frame data short)
Device = 4	(DBT)
Error = 0	(DBT fault)

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Device = 5   (SIS - 704)

Error = 0   (write busy)
    = 1   (write fault)

b) SIS Frame Error/Status

ID
DATA

ID = /0003

DATA = error/state

c) SIS Frame Parity Error

ID
DATA(1)
DATA(2)

ID = /8005

DATA(1) = previous frame

DATA(2) = count

d) Read not Ready (Loss of Data)

ID
DATA(1)
DATA(2)

ID = /8006

DATA(1) = expected frame

DATA(2) = count

e) SIS Frame Out of Time (Loss of Data)

ID
DATA(1)
DATA(2)

ID = /8007

DATA(1) = frame count 1

DATA(2) = frame count 2

f) SIS Frame Count Error (Loss of Data)

ID
DATA
DATA

ID = /8008

DATA(1) = expected frame

DATA(2) = count

3.4 SIS FRAME COUNT

ID
DATA(1)
DATA(2)

ID = /8004

DATA(1) = frame count 1

DATA(2) = frame count 2

3.5 LOGICAL TERMINATOR

End of valid information within a physical record may only occur once (validly) in each record.

ID

ID = 0

4. CDT DATA BASE CCT

The SAIL CDT Data Base CCT contains information to interpret both TICM and TOC CDT's. Three types of information are included.

1. Correspondence of data word ID to measurement ID.

2. Identification of data type to allow proper decoding and formatting of the data values on the TICM and TOC CDT's.

3. Calibration data so that measurements can be converted to engineering units.

The CDT Data Base CCT consists of seven files. Each record in these files will contain 320 words of 16 bits each. All characters are written in EBCDIC. The tape will contain seven tracks and will be written at 556 bpi.

The files contained on the tape are as follows:

- o File 1 - Disk Header Records
- o File 2 - Disk Directory Records
- o File 3 - Calibration Data Records
- o File 4 - States Records
- o File 5 - Measurement Data Records
- o File 6 - PCM Format Records
- o File 7 - Nomenclature Records

Files 1 and 5 are parallel recorded in regard to sequence. Pointers in file 5 can be used for direct access to other files. The CDT Data Base CCT is structured as follows:

```
┌─────────────────────────────┐
│                             │
│          HEADER             │    FILE 1
│                             │
├─────────────────────────────┤
│            EOF              │
├─────────────────────────────┤
│         DIRECTORY           │    FILE 2
│          RECORDS            │
│                             │
├─────────────────────────────┤
│            EOF              │
├─────────────────────────────┤
│        CAL RECORDS          │    FILE 3
│                             │
│                             │
├─────────────────────────────┤
│            EOF              │
├─────────────────────────────┤
│          STATES             │    FILE 4
│          RECORDS            │
│                             │
├─────────────────────────────┤
│            EOF              │
├─────────────────────────────┤
│           DATA              │
│       BLOCK RECORDS         │    FILE 5
│                             │
├─────────────────────────────┤
│            EOF              │
├─────────────────────────────┤
│           PCM               │
│         ADDRESSES           │    FILE 6
│          RECORDS            │
├─────────────────────────────┤
│            EOF              │
├─────────────────────────────┤
│       NOMENCLATURE          │    FILE 7
│          RECORDS            │
├─────────────────────────────┤
│            EOF              │
└─────────────────────────────┘
```

FILE 1 contains Disk Header Records:

DISK HEADER RECORD 1

Word	Description
1 - 5	File name (EBCDIC)
6	Month ⎫ Date of last update
7	Day ⎬ (Use for cal. data effectivity ID)
8	Year ⎭
9	Disk address by directory
10	Number of entries in measurement directory
11	Disk address of calibration records
12	Number of blocks used for calibrations
13	Disk address of states records
14	Number of states entries
15	Disk address of measurement records
16	Number of blocks used for measurements
17	Number of measurements
18	Disk address of PCM formats
19	Number of blocks used for PCM formats
20	Next ID assigned for measurements
21	Next ID assigned for Globals
22	Directory sector WRITE indicator
23	Directory sector number to write
24	Cals sector WRITE indicator
25	Cals sector number to write
26	States sector WRITE indicator
27	States sector number to write
28	Data sector WRITE indicator
29	Data sector number to write
30	PCM format sector WRITE indicator
31	PCM format sector number to write
32	Next directory sector to use
33	Next directory record to use
34	Next calibration data sector to use

Word	Description
35	Next calibration data record to use
36	Next states value sector to use
37	Next states value record to use
38	Next data sector to use
39	Next data record to use
40	Original number of measurements and Globals for the data base
41	Next states position indicator
42	Current number of measurements
43	Current number of Globals
44	Next PCM format sector to use
45	Next PCM record to use
46	Next nomenclature record to use
47	Next nomenclature block to use
48- 49	Not used
50	Directory Record by File
51	Directory Block
52	Calibration Record by File
53	Calibration Block
54	State Record by File
55	State Block
56	Data Block Record by File
57	Data Block
58	PCM Record by File
59	PCM Block
60	Nomenclature Record by File
61	Nomenclature Block
62	Next System ID for Limit Check Data (PCM 16 bits or less)
63	First System ID for nonlimit Check Data (Currently 0201_{16})
64	First System ID for Limit Check Data (Varies with each data base.
65-320	Not used.

FILE 2 contains Disk Directory Records:

Word	Description
1 - 6	Measurement number (EBCDIC)
7	System ID number (0000-1FFF Hex)
8	Address of measurement data records
	Bits 0 - 11 = Physical record number
	Bits 12 - 15 = Logical record number Refers to File 5
9	Hexidecimal identification number Refers to File 5
10	Routing (Zero indicates PCM data) Refers to File 5

NOTE: A record in the Disk Directory can contain up to 32
        directory sets.

Words 7 and 9 contain identical information.

FILE 3 contains Calibration Records:

Word	Description
1 - 11	Up to 11 count values (16 bit 2's complement integers)
12 - 22	Up to 11 engineering unit values

NOTE: A record in the Disk Calibration area can contain up to 14 calibration sets. The last 12 words of the record are unused.

Count values are in ascending order. Engineering unit values are in corresponding order, but may not be ascending.

FILE 4 contains States Records: Unused in IDSD processing.

FILE 5 contains Measurement Data Records:

Word	Description
1 - 6	Measurement number (EBCDIC)
7	System ID number (0000-1FFF Hex)
8 - 10	Engineering units description (1 - 5 characters) in EBCDIC
11	Data classification and routing information

BP 0   PCM Rate
            0 = Not PCM
            1 = 128 kbps rate

BP 1 - 5   Data Description*
            0 = Discrete
            1 = 1-bit analog
            2 = 2-bit analog
            3 = 3-bit analog
            4 = 4-bit analog
            5 = 5-bit analog
            6 = 6-bit analog
            7 = 7-bit analog
            8 = 8-bit analog
            9 = 9-bit analog
          10 = 10-bit analog
          11 = 11-bit analog
          12 = 12-bit analog
          13 = 13-bit analog
          14 = 14-bit analog
          15 = 15-bit analog
          16 = 16-bit analog
          17 = 32-bit analog
          18 = 64-bit analog
          19 = 32-bit floating point**
          20 = 64-bit floating point**

BP 6   Analog Characteristics
            1 = Unpacked analog
            0 = Packed analog (TICM data only)
BP 7   Unused
BP 8 - 9   Sign
            0 = Unipolar +
            1 = 2's complement
            2 = Absolute binary

*Data words are right-adjusted and may have extraneous bits filling the rest of a 16-bit word.
**Expanded in DECOM by appending 16 bits of all zeros before routing to ACM and CDT's.

Word	Description

BP 10 - 15 Routing Information
     0 = PCM
     1 = GSIU
     2 = Not used
     3 = Not used
     4 = Launch Data Bus
     5 = ATA Converter to TICM
     6 = SIS to TICM
     7 = Global ID for Multi-Console
   63 = Meas/Global Deleted

12   Disk Buffer Address of States
    BP 0   Block position information
           0 = First set in block
           1 = Second set in block
    BP 1-11 Relative address of physical record number
       12-15 Logical record number (0-15)

13   Disk Buffer Address of Calibration Data (See note 2)
    BP 0-11 Physical record number   File 3
       12-15 Logical record number

14   Calibration Information
    BP 0-3   Aperture, PCM(1-8), TICM(POWER OF TWO)
    BP 4-7   Number of States
    BP 8-12 Number of Calibration Pairs
    BP 13-15 Scale Factor = N   (divide by 10^N for decimal place)

15-20 The contents of these words will depend upon the Data Classification and Routing Information word (Word 11).

Routing Indicator = 0 (PCM, including facility data)

	Description

15   Number of PCM formats
16   Physical record number   File 6 (See note 3)
17   Logical record number

18   Format Type

    0 = OI
    1 = 64
    2 = BFCS
    3 = PFCS

19   Physical record number in Nomenclature file (see note 4)

20   BP 0-7   Processing Code (See note 5)
          BP 8-15 Logical record number in Nomenclature file

ROUTING INDICATOR = 1 (GSIU)

WORD	DESCRIPTION
15	Cell/Channel/Fragment
	BP 1-7 Cell Address (0-127)
	BP 8-13 Channel in Cell (0-63)
	BP 14-15 Fragment for Discretes (0-3)
16	Aperture (0-4095)
17-18	Not used
19	Relative address of nomenclature record
20	BP 0-7 IDSD Processing Code (See note 5)
	BP 8-15 Block Number (0-16)

ROUTING INDICATOR = 4 (LAUNCH DATA BUS)

WORD	DESCRIPTION
15-18	To be defined
19	Relative Address of Nomenclature Record
20	BP 0-7 IDSD Processing Code (See note 5)
	BP 8-15 Block Number (0-16)

ROUTING INDICATOR = 5 and 6 (TICM)

WORD	DESCRIPTION

15

Command Address
BP 4-6 Converter Type
BP 7-15 FS Converter Address

16

Processing Information

BP0   Transmit Code
                0 = Route to TOC
                1 = Do not route to TOC

BP 4-7   Fragment for discretes
or starting bit position for
TICM packed data

BP 8-15   Processing Code
                0 = Single Precision
                1 = Double Precision
                2 = Discrete
                3 = Packed Single Precision

17

Floating point data type as received from SIS:

0000 = not floating point data

0001 = Flight System (sign magnitude)

0002 = SEL 32 floating point

0003 = INTEL 8080 floating point

18   Not used

19   Relative address of nomenclature record.

20   BP 0-7 IDSD Processing Code (See Note 5)

BP 8-15 Block Number (0-16)

ROUTING INDICATOR = 7 (GLOBAL)

WORD	DESCRIPTION

15-18   Not used.

19   Relative Address of Nomenclature Record

20   BP 0-7 IDSD Processing Code (See note 5)

BP 8-15 Block Number (0-16)

FILE 6 contains PCM Format Records:

Word	Description
1	PCM address #1
	BP 0 - Unused
	BP 1 - 7 Frame Number
	BP 8 - 15 Word Number
2	Fragment/Sample Rate/Format Number

BP 0 - 3 Fragment (BP 0 = MSB, bit position for discretes, 0-15 for GPC, 0-7 for OI)

BP 4 - 7 Sample Rate

    1 = 1 Sample/Data Cycle

    2 = 2 Samples/Data Cycle

    3 = 5 Samples/Data Cycle

    4 = 10 Samples/Data Cycle

    5 = 12.5 Samples/Data Cycle

    6 = 20 Samples/Data Cycle

    7 = 25 Samples/Data Cycle

    8 = 50 Samples/Data Cycle

    9 = 100 Samples/Data Cycle

BP 8 - 15 Format Number

Word	Description
3	PCM Address #2
4	Frag/SR/Format No. for Address #2
5	PCM Address #3
6	Frag/SR/Format No. for Address #3
7	PCM Address #4
8	Frag/SR/Format No. for Address #4
9	PCM Address #5
10	Frag/SR/Format No. for Address #5
11	PCM Address #6

Word	Description
12	Frag/SR/Format No. for Address #6
13	PCM Address #7
14	Frag/SR/Format No. for Address #7
15	PCM Address #8
16	Frag/SR/Format No. for Address #8
17	PCM Address #9
18	Frag/SR/Format No. for Address #9
19	PCM Address #10
20	Frag/SR/Format No. for Address #10
21	PCM Address #11
22	Frag/SR/Format No. for Address #11
23	PCM Address #12
24	Frag/SR/Format No. for Address #12
25	PCM Address #13
26	Frag/SR/Format No. for Address #13
27	PCM Address #14
28	Frag/SR/Format No. for Address #14
29	PCM Address #15
30	Frag/SR/Format No. for Address #15
31	PCM Address #16
32	Frag/SR/Format No. for Address #16

NOTE: A record in the PCM Format Area can contain up to 10 Format sets

FILE 7 contains Nomenclature Records:

Word	Description
1-18	Nomenclature in EBCDIC

NOTE: A record in the Nomenclature block can contain up to 17 nomenclatures. The last 14 words are not used. Bits 8-15 in the last word are not used and are set to a blank.

SPECIAL NOTES

1. No main memory dump data will be recorded on the CDT.

2. If word 13 of file 5 logical record contains all binary 1's (word 13=65535), there are no calibration pairs available for this measurement.

3. If word 16 of a file 5 logical record (for routing indicator=0) contains all binary 1's (word 16=65535), there are no file 6 logical records for this measurement. Assume the bit position for this measurement is zero.

4. If word 19 of a file 5 logical record contains all binary 1's (word 19=65535), there is no nomenclature available for this measurement. Assume the following nomenclature "NOMENCLATURE NOT AVAILABLE."

5. The Processing Codes define the encoding convention used to represent a specific measurement's data values on the SAIL CDT. These codes are explained in the following table:

PC	**EXAMPLE	DATA TYPE	COMMENT
0	--	--	Undefined or N/A
1	MXXXXL	HXU, FXU BD, BSU* EMD*	Fixed point unsigned
2	SMXXXL	HXS, FXS BSS, AMB	Fixed point signed -- two's compliment
3	SNMXXL	HFS	Fixed point signed -- two's compliement with a notification bit (N) of an overflow
4	SEF	SPL, HPL, EPL	Floating point signed, 32 bits
5	SEFF	DPL	Floating point signed, 64 bits
6	OMXXXL	AMU	Fixed point, sign bit fixed at zero
7	xxxxxx	HMD, FMD	Parent Measurement. Must examine sub-meas for processing

TIME WORDS

8	DHMS.S	EMD	OI GMT, MET time measurements
9	MS.S	BSU	GPC time measurement First 16 bits -- LSB = 30 min. Remaining 32 bits--LSB = 1 micro sec (reset at 30 min).
16	RMXXXL	EMS	Fixed point with directional bit---do not compliment

CODED DECIMAL WORDS (BCD)

10	OKKHHHHTTTTUUUUO	Measurements with bits representing thousands (K-kilo), hundreds (H), tens (T), units (U), tenths (D-deci), and hundredths (C-centi)
11	HHTTTTUUUUDDDD	
12	CCCC	
13	HHTTTTUUUU	Each letter represents one bit.
14	TTUUUU	
15	TTTUUUU	

* Time measurements and special measurements are exceptions.
** See ALT Telemetry Data Format Control Book, Vol. 1 for detail formats.

Character Codes of the Example

One Character Per Bit

S   Sign bit 0=positive   1=negative--If negative two's compliment
                                             data bits.

M   Most significant bit

L   Least significant bit

N   Notifier bit that a measurement has exceed its maximum value.

K   Thousands bit (kilo)

H   Hundreds bit

T   Tens bit

U   Units bit

D   Tenths bit (deci)

C   Hundredths bit (centi)

O   Bit always = 0

1   Bit always = 1

R   Reverse direction bit--Do not compliment data bits.

One Character for Several Bits

E   Exponet bits

F   Fraction bits

X   Middle data bits

D   Day bits

H   Hour bits

M   Minute bits

S   Second bits

S   Fraction of seconds bits

5. Instrumentation Tapes

Ampex FR1400 Tape Format

Data Input	128Kbps (serial)
Source	ATA PCM Master Unit
PCM Code	Bi-Phase-L (Manchester II)
Word Length	8 bits
Minor Frame	160 words
Master Frame	100 Minor Frames
Type of Recording	Wideband Direct
Tape Speed	15 ips
Tape Speed Compensation	None
Tape Width	1/2 inch
Tracks	7
Timing	IRIG B

Track Assignments

Track	Assignment	Mode
1	Voice	FM
2	25Kc oscillator	Direct
3	128 kbs PCM	Direct
4	Timing	FM
5	EIU PCM	Direct
6	128 kbs PCM	Direct
7	Timing	Direct